

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently amended) A safety system for an industrial press having a moveable section defining a leading edge and a stationary section, the safety system including:

 a laser device for emitting a plurality of parallel continuous planar beams having a generally constant lateral width; wherein the planar beams are located between the moveable and stationary sections of the industrial press and each planar beam is spaced at a different distance to the leading edge of the moveable section such that a first planar beam is spaced further from the leading edge than a second planar beam;

 a light receiver for receiving the planar beams and for detecting when an object intersects at least one of the planar beams; and

 a controller for stopping or preventing motion of the moveable section when the light receiver detects that at least one of the planar beams has intersected an object,

 said controller further adapted to decelerate the moveable section from a first speed to a second speed within a deceleration zone, said zone defined between a first point at which [a] the first planar beam passes a speed control point and a second point at which [a] the second planar beam passes the speed control point, wherein the first and second speeds of the moveable section are measured at the first and second points, respectively.

2. (Original) The safety system according to claim 1 wherein the first and second planar beams are adjacent.

3. (Previously presented) The safety system according to claim 1 wherein the laser device includes a plurality of laser emitters for respectively emitting a laser beam and a lens assembly for respectively converting each said laser beam emitted from a said laser emitter to a said continuous planar laser beam.

4. (Currently amended) The safety system according to claim 3 wherein the lens assembly includes a cylindrical prism for initially expanding ~~the~~ or each laser beam into a

planar fan-shaped laser beam and a converging lens for refocusing the fan-shaped laser beam to a planar laser beam having a generally constant lateral width.

5. (Previously presented) The safety system according to claim 4 wherein the lens assembly is used to convert each laser beam to facilitate the correct alignment of the final planar laser beam.
6. (Original) The safety system according to claim 1 further including a plurality of laser devices used to provide the continuous planar laser beams.
7. (Previously presented) The safety system according to claim 4 wherein peripheral edges of the plane defined by the planar laser beam extend laterally beyond opposing sides of the moveable section.
8. (Previously presented) The safety system according to any one of the preceding claims wherein a single light receiver is used to receive the planar beams.
9. (Previously presented) The safety system according to claim 1 wherein the light receiver includes an array of light receiving elements, the elements being aligned along a common axis and located at an end of a receiver body of the light receiver.
10. (Previously presented) The safety system according to claim 9 wherein a cylindrical lens is provided to focus the planar laser beams onto the light receiver array.
11. (Previously presented) The safety system according to claim 1 wherein the planar laser beams are multiplexed such that each laser beam is sequentially turned off and on creating pulses so that the light receiver only detects one of said laser beams at one time.
12. (Original) The safety system according to claim 11 wherein the pulses are created at a pre-determined pulse rate.

13. (Canceled)

14. (Canceled)

15. (Canceled)

16. (Canceled)

17. (Currently amended) The safety system according to claim 46 1 wherein the speed measurement is performed by the controller, said controller measuring a number of pulses at a pulse rate as the moveable section travels a predetermined distance, to determine the first and second speed measurement.

18. (Previously presented) The safety system according to claim 17 wherein the predetermined distance is bisected by the speed control point, whereat a further speed measurement is conducted to determine that the deceleration of the moveable section had occurred.

19. (Previously presented) The safety system according to claim 18 wherein the predetermined distance is a deceleration zone of 2 mm commencing 1 mm above the speed control point and finishing 1 mm below the speed control point.

20. (Currently amended) The safety system according to claim 46 1 wherein the first speed is a maximum operating speed of the industrial press.

21. (Previously presented) The safety system according to claim 20 wherein the second speed is a final crawl speed.

22. (Previously presented) The safety system according to claim 21 wherein the controller decelerates the moveable section at a rate such that the speed of the moveable section as a mid point between the first point and second point passes the speed control point is 50% of the operating speed of the industrial press.

23. (Previously presented) The safety system according to claim 21 wherein if the speed measurement detects a speed exceeding the first speed at the first point, the final crawl speed at the second point or 50% of the operating speed at the mid point, then the controller will stop the moveable section by shutting off the industrial press.

24. (Previously presented) The safety system according to claim 1 wherein as each planar beam passes the speed control point the respective planar laser beam is muted whereby intersection of the planar beam by the object will not prevent motion of the moveable section.

25. (Original) The safety system according to claim 24 wherein the muted planar laser beam is still pulsed and speed measurement is still possible.

26. (Currently amended) The safety system according to claim 46 1 wherein the speed control point is located 2 mm above a surface of material operated on by the industrial press.

27. (Currently amended) The safety system according to claim 46 1 wherein the first and second planar laser beams are spaced along an axis parallel to the movement of the moveable section by 10 mm.

28. (Currently amended) The safety system according to claim 46 1 wherein the first planar laser beam and the moveable section are spaced along an axis parallel to the movement of the moveable section by 4 mm.

29. (Previously presented) The safety system according to claim 21 wherein the final crawl speed is 20 mm per second.

30. (Currently amended) The safety system according to claim 46 1 wherein the controller further decelerates the moveable section from the second point to a third point, said third point located at which the leading edge of the moveable section passes the speed control point.

31. (Original) The safety system according to claim 30 wherein the moveable section is decelerated from 20 mm per second to 10 mm per second between the second point and the third point.

32. (Currently amended) A safety system for an industrial press having a moveable section, the safety system including:

a laser device for emitting a continuous beam of rectilinear cross-section having a generally constant lateral width and generally constant depth;

said rectilinear beam having a proximate and distal face relative to a leading edge of the moveable section;

a light receiver for receiving the rectilinear beam and for detecting when an object intersects at least a portion of the beam; and

a controller for stopping or preventing motion of the moveable section when the light receiver detects that at least a portion of the rectilinear beam has intersected an object,

said controller further adapted to decelerate the moveable section from a first speed to a second speed within a deceleration zone, said zone defined between a first point at which the proximate face passes a speed control point and a second point at which the distal face passes the speed control point, wherein the first and second speeds of the moveable section are measured at the first and second points, respectively.

33. (Canceled)

34. (Previously presented) The safety system according to claim 32 wherein the speed measurement is performed by the controller measuring a number of pulses at a pulse rate as the moveable section travels a predetermined distance.

35. (Original) The safety system according to claim 34 wherein the predetermined distance is bisected by the speed control point.

36. (Original) The safety system according to claim 35 wherein the predetermined distance is 2 mm commencing 1 mm above the speed control point and finishing 1 mm below the speed control point.

37. (Previously presented) The safety system according to claim 32 wherein the first speed is a maximum operating speed of the industrial press.

38. (Previously presented) The safety system according to claim 37 wherein the second speed is a final crawl speed.

39. (Previously presented) The safety system according to claim 38 wherein the controller decelerates the moveable section at a rate such that the speed of the moveable section at a mid point between the first point and second point that passes the speed control point is 50% of the operating speed of the industrial press.

40. (Previously presented) The safety system according to claim 39 wherein if the speed measurement detects a speed exceeding the first speed at the first point, the final crawl speed at the second point or 50% of the operating speed at the mid point, then the controller will stop the moveable section by turning off the industrial press.

41. (Previously presented) The safety system according to claim 32 wherein as the rectilinear beam progressively passes the speed control point the rectilinear beam is

correspondingly progressively muted whereby intersection of the rectilinear beam at a muted portion of the rectilinear beam by the object will not prevent motion of the moveable section.

42. (Original) The safety system according to claim 41 wherein the muted portion of the rectilinear beam is still pulsed and speed measurement is still possible.

43. (Previously presented) The safety system according to claim 32 wherein the speed control point is located 2 mm above a surface of material operated on by the industrial press.

44. (Previously presented) The safety system according to claim 32 wherein the depth of the rectilinear beam is 10 mm.

45. (Previously presented) The safety system according to claim 32 wherein the proximate face and the moveable section are spaced along an axis parallel to the movement of the moveable section by 4 mm.

46. (Previously presented) The safety system according to claim 40 wherein the final crawl speed is 20 mm per second.

47. (Previously presented) The safety system according to claim 46 wherein the controller further decelerates the moveable section from the second point to a third point, said third point located at which the leading edge of the moveable section passes the speed control point.

48. (Original) The safety system according to claim 47 wherein the moveable section is decelerated from 20 mm per second to 10 mm per second between the second point and the third point.

49. (Previously presented) The safety system according to claim 32 wherein the laser device includes a plurality of laser emitters for respectively emitting a laser beam and a lens assembly for respectively converting each said laser beam emitted from a said laser emitter to a said continuous rectilinear laser beam.

50. (Original) The safety system according to claim 49 wherein the lens assembly includes a first cylindrical prism for initially expanding the or each laser beam into a planar fan-shaped laser beam in one plane, a first converging lens for refocusing the fan-shaped laser beam to a planar laser beam having the generally constant lateral width, a second cylindrical prism, orthogonal to the first cylindrical prism, for expanding the planar laser beam into a prismatic fan-shaped laser beam and a second converging lens for refocusing the prismatic fan-shaped laser beam to a rectilinear laser beam having both the generally constant lateral width and the generally constant depth.

51. (Previously presented) The safety system according to claim 32 wherein the light receiver includes a two dimensional array of light receiving elements, the elements being placed in a rectilinear distribution and located at an end of a receiver body of the light receiver.

52. (Previously presented) The safety system according to claim 32 said rectilinear beam further including a rectilinear portion of depth sufficient to span from the proximate face to a partial intersection with the leading edge of the moveable section, said rectilinear portion having the generally constant lateral width, wherein the light receiver further includes light receiving elements corresponding to the rectilinear portion, such that the light receiving elements corresponding to an area where the moveable section intersects with the rectilinear portion do not function to prevent movement of the moveable section.

53. (Canceled)

54. (Canceled)

55. (Canceled)

56. (Canceled)

57. (Currently amended) A method of operating a safety system for an industrial press having a moveable section and a stationary section, the safety system providing a plurality of continuous planar laser beams having a generally constant lateral width, each laser beam being located between the moveable and stationary sections of the industrial press and spaced at varying distances from the moveable section such that a first laser beam is spaced further from the moveable section than a second laser beam, the first and second laser beams defining a deceleration zone, the method including moving the moveable section towards the stationary section at a relatively high speed;

starting deceleration of the moveable section to a first speed when ~~one said the~~ first laser beam reaches a speed control point located immediately adjacent the stationary section[,];

moving the moveable section at a final crawl speed when ~~a~~ the second said laser beam reaches the speed control point, the moveable section continuing to move at said final crawl speed towards said stationary section;

measuring the first speed of the moveable section as the first laser beam reaches the speed control point; and

measuring the final crawl speed of the moveable section as the second laser reaches the speed control point.

58. (New) A method of operating a safety system for an industrial press having a moveable section and a stationary section, the safety system providing a plurality of continuous planar laser beams having a generally constant lateral width, each laser beam being spaced at varying distances from the moveable section, the method including moving the moveable section towards the stationary section at a relatively high speed;

starting deceleration of the moveable section when one said laser beam reaches a speed control point located immediately adjacent the stationary section;

moving the moveable section at a final crawl speed when a second said laser beam reaches the speed control point, the moveable section continuing to move at said final crawl speed towards said stationary section; and

muting each laser beam as it passes the speed control point such that intersection of the laser beam by an object will not prevent motion of the moveable section.

59. (New) A method of operating a safety system for an industrial press having a moveable section and a stationary section, the safety system providing a plurality of rectilinear laser beams having rectilinear cross-sections of generally constant lateral width and generally constant depth, each rectilinear laser beam being spaced at varying distances from the moveable section, the method including moving the moveable section towards the stationary section at a relatively high speed;

starting deceleration of the moveable section when one said rectilinear laser beam reaches a speed control point located immediately adjacent the stationary section;

moving the moveable section at a final crawl speed when a second said rectilinear laser beam reaches the speed control point, the moveable section continuing to move at said final crawl speed towards said stationary section; and

measuring the first speed of the moveable section as the first laser beam reaches the speed control point; and

measuring the second speed of the moveable section as the second laser reaches the speed control point.

60. (New) A method of operating a safety system for an industrial press having a moveable section and a stationary section, the safety system providing a plurality of rectilinear laser beams having rectilinear cross-sections of generally constant lateral width and generally constant depth, each rectilinear laser beam being spaced at varying distances from the moveable section, the method including moving the moveable section towards the stationary section at a relatively high speed;

starting deceleration of the moveable section when one said rectilinear laser beam reaches a speed control point located immediately adjacent the stationary section;

moving the moveable section at a final crawl speed when a second said rectilinear laser beam reaches the speed control point, the moveable section continuing to move at said final crawl speed towards said stationary section; and

progressively muting each rectilinear laser beam as it progressively passes the speed control point such that intersection of a muted portion of the rectilinear laser beam by an object will not prevent motion of the moveable section.

61. (New) A safety system for an industrial press having a moveable section, the safety system including:

a laser device for emitting a plurality of parallel continuous planar laser beams having a generally constant lateral width;

a light receiver for receiving the planar laser beams and for detecting when an object intersects at least one of the planar laser beams; and

a controller for stopping or preventing motion of the moveable section when the light receiver detects that at least one of the planar laser beams has intersected an object,

said controller further adapted to decelerate the moveable section from a first speed to a second speed within a deceleration zone, said zone defined between a first point at which a first planar laser beam passes a speed control point and a second point at which a second planar laser beam passes the speed control point;

wherein as each planar laser beam passes the speed control point, the planar laser beam is muted such that intersection of the planar laser beam by the object will not prevent motion of the moveable section.

62. (New) The safety system according to claim 61 wherein the first and second planar laser beams are adjacent.

63. (New) The safety system according to claim 61 wherein the laser device includes a plurality of laser emitters for respectively emitting a laser beam and a lens assembly for

respectively converting each said laser beam emitted from a said laser emitter to a said continuous planar laser beam.

64. (New) The safety system according to claim 63 wherein the lens assembly includes a cylindrical prism for initially expanding each planar laser beam into a planar fan-shaped laser beam and a converging lens for refocusing the fan-shaped laser beam to a planar laser beam having a generally constant lateral width.

65. (New) The safety system according to claim 64 wherein the lens assembly is used to convert each laser beam to facilitate the correct alignment of the final planar laser beam.

66. (New) The safety system according to claim 61 further including a plurality of laser devices used to provide the continuous planar laser beams.

67. (New) The safety system according to claim 64 wherein peripheral edges of the plane defined by the planar laser beam extend laterally beyond opposing sides of the moveable section.

68. (New) The safety system according to any one of claims 61 – 67 wherein a single light receiver is used to receive the planar laser beams.

69. (New) The safety system according to claim 61 wherein the light receiver includes an array of light receiving elements, the elements being aligned along a common axis and located at an end of a receiver body of the light receiver.

70. (New) The safety system according to claim 69 wherein a cylindrical lens is provided to focus the planar laser beams onto the light receiver array.

71. (New) The safety system according to claim 61 wherein the planar laser beams are multiplexed such that each laser beam is sequentially turned off and on creating pulses so that the light receiver only detects one of said planar laser beams at one time.

72. (New) The safety system according to claim 71 wherein the pulses are created at a pre-determined pulse rate.

73. (New) The safety system according to claim 61 wherein the muted planar laser beam is still pulsed and speed measurement is still possible.

74. (New) A safety system for an industrial press having a moveable section, the safety system including:

a laser device for emitting a continuous beam of rectilinear cross-section having a generally constant lateral width and generally constant depth;

said rectilinear beam having a proximate and distal face relative to a leading edge of the moveable section;

a light receiver for receiving the rectilinear beam and for detecting when an object intersects at least a portion of the beam; and

a controller for stopping or preventing motion of the moveable section when the light receiver detects that at least a portion of the rectilinear beam has intersected an object,

said controller further adapted to decelerate the moveable section from a first speed to a second speed within a deceleration zone, said zone defined between a first point at which the proximate face passes a speed control point and a second point at which the distal face passes the speed control point;

wherein as the rectilinear beam progressively passes the speed control point, the rectilinear beam is correspondingly progressively muted such that intersection of the rectilinear beam at a muted portion of the rectilinear beam by the object will not prevent motion of the moveable section.

75. (New) The safety system according to claim 74 wherein the speed measurement is performed by the controller measuring a number of pulses at a pulse rate as the moveable section travels a predetermined distance.

76. (New) The safety system according to claim 75 wherein the predetermined distance is bisected by the speed control point.

77. (New) The safety system according to claim 76 wherein the predetermined distance is 2 mm commencing 1 mm above the speed control point and finishing 1 mm below the speed control point.

78. (New) The safety system according to claim 74 wherein the first speed is a maximum operating speed of the industrial press.

79. (New) The safety system according to claim 78 wherein the second speed is a final crawl speed.

80. (New) The safety system according to claim 79 wherein the controller decelerates the moveable section at a rate such that the speed of the moveable section at a mid point between the first point and second point that passes the speed control point is 50% of the operating speed of the industrial press.

81. (New) The safety system according to claim 80 wherein if the speed measurement detects a speed exceeding the first speed at the first point, the final crawl speed at the second point or 50% of the operating speed at the mid point, then the controller will stop the moveable section by turning off the industrial press.

82. (New) The safety system according to claim 74 wherein the muted portion of the rectilinear beam is still pulsed and speed measurement is still possible.

83. (New) The safety system according to claim 74 wherein the speed control point is located 2 mm above a surface of material operated on by the industrial press.

84. (New) The safety system according to claim 74 wherein the depth of the rectilinear beam is 10 mm.

85. (New) The safety system according to claim 74 wherein the proximate face and the moveable section are spaced along an axis parallel to the movement of the moveable section by 4 mm.

86. (New) The safety system according to claim 81 wherein the final crawl speed is 20 mm per second.

87. (New) The safety system according to claim 86 wherein the controller further decelerates the moveable section from the second point to a third point, said third point located at which the leading edge of the moveable section passes the speed control point.

88. (New) The safety system according to claim 87 wherein the moveable section is decelerated from 20 mm per second to 10 mm per second between the second point and the third point.

89. (New) The safety system according to claim 74 wherein the laser device includes a plurality of laser emitters for respectively emitting a laser beam and a lens assembly for respectively converting each said laser beam emitted from a said laser emitter to a said continuous rectilinear laser beam.

90. (New) The safety system according to claim 89 wherein the lens assembly includes a first cylindrical prism for initially expanding the or each laser beam into a planar fan-shaped laser beam in one plane, a first converging lens for refocusing the fan-shaped laser beam to a planar laser beam having the generally constant lateral width, a second cylindrical prism,

orthogonal to the first cylindrical prism, for expanding the planar laser beam into a prismatic fan-shaped laser beam and a second converging lens for refocusing the prismatic fan-shaped laser beam to a rectilinear laser beam having both the generally constant lateral width and the generally constant depth.

91. (New) The safety system according to claim 74 wherein the light receiver includes a two dimensional array of light receiving elements, the elements being placed in a rectilinear distribution and located at an end of a receiver body of the light receiver.

92. (New) The safety system according to claim 74 said rectilinear beam further including a rectilinear portion of depth sufficient to span from the proximate face to a partial intersection with the leading edge of the moveable section, said rectilinear portion having the generally constant lateral width, wherein the light receiver further includes light receiving elements corresponding to the rectilinear portion, such that the light receiving elements corresponding to an area where the moveable section intersects with the rectilinear portion do not function to prevent movement of the moveable section.

93. (New) A safety system for an industrial press having a moveable section, the safety system including:

a laser device for emitting a continuous beam of rectilinear cross-section having a generally constant lateral width and generally constant depth;

said rectilinear beam having a proximate and distal face relative to a leading edge of the moveable section;

a light receiver for receiving the rectilinear beam and for detecting when an object intersects at least a portion of the beam; and

a controller for stopping or preventing motion of the moveable section when the light receiver detects that at least a portion of the rectilinear beam has intersected an object,

said controller further adapted to decelerate the moveable section from a first speed to a second speed within a deceleration zone, said zone defined between a first point at which

the proximate face passes a speed control point and a second point at which the distal face passes the speed control point;

 said rectilinear beam further including a rectilinear portion of depth sufficient to span from the proximate face to a partial intersection with the leading edge of the moveable section, said rectilinear portion having the generally constant lateral width, wherein the light receiver further includes light receiving elements corresponding to the rectilinear portion, such that the light receiving elements corresponding to an area where the moveable section intersects with the rectilinear portion do not function to prevent movement of the moveable section.

94. (New) The safety system according to claim 93 wherein the speed measurement is performed by the controller measuring a number of pulses at a pulse rate as the moveable section travels a predetermined distance.

95. (New) The safety system according to claim 94 wherein the predetermined distance is bisected by the speed control point.

96. (New) The safety system according to claim 95 wherein the predetermined distance is 2 mm commencing 1 mm above the speed control point and finishing 1 mm below the speed control point.

97. (New) The safety system according to claim 93 wherein the first speed is a maximum operating speed of the industrial press.

98. (New) The safety system according to claim 97 wherein the second speed is a final crawl speed.

99. (New) The safety system according to claim 98 wherein the controller decelerates the moveable section at a rate such that the speed of the moveable section at a mid point between

the first point and second point that passes the speed control point is 50% of the operating speed of the industrial press.

100. (New) The safety system according to claim 99 wherein if the speed measurement detects a speed exceeding the first speed at the first point, the final crawl speed at the second point or 50% of the operating speed at the mid point, then the controller will stop the moveable section by turning off the industrial press.

101. (New) The safety system according to claim 93 wherein the speed control point is located 2 mm above a surface of material operated on by the industrial press.

102. (New) The safety system according to claim 93 wherein the depth of the rectilinear beam is 10 mm.

103. (New) The safety system according to claim 93 wherein the proximate face and the moveable section are spaced along an axis parallel to the movement of the moveable section by 4 mm.

104. (New) The safety system according to claim 100 wherein the final crawl speed is 20 mm per second.

105. (New) The safety system according to claim 104 wherein the controller further decelerates the moveable section from the second point to a third point, said third point located at which the leading edge of the moveable section passes the speed control point.

106. (New) The safety system according to claim 105 wherein the moveable section is decelerated from 20 mm per second to 10 mm per second between the second point and the third point.

107. (New) The safety system according to claim 93 wherein the laser device includes a plurality of laser emitters for respectively emitting a laser beam and a lens assembly for respectively converting each said laser beam emitted from a said laser emitter to a said continuous rectilinear laser beam.

108. (New) The safety system according to claim 107 wherein the lens assembly includes a first cylindrical prism for initially expanding the or each laser beam into a planar fan-shaped laser beam in one plane, a first converging lens for refocusing the fan-shaped laser beam to a planar laser beam having the generally constant lateral width, a second cylindrical prism, orthogonal to the first cylindrical prism, for expanding the planar laser beam into a prismatic fan-shaped laser beam and a second converging lens for refocusing the prismatic fan-shaped laser beam to a rectilinear laser beam having both the generally constant lateral width and the generally constant depth.

109. (New) The safety system according to claim 93 wherein the light receiver includes a two dimensional array of light receiving elements, the elements being placed in a rectilinear distribution and located at an end of a receiver body of the light receiver.